WRD Resource Room OLYM

Value Planning

Final Report

Elwha River Water Quality Mitigation Project
75-Percent Concept Development

A1R-1751-3408-NPS-11-0-5 (1); ELWH3

February 16, 2001

Conducted in Cooperation with the National Park Service,
the City of Port Angeles, the Lower Elwha Klallam Tribe,
and Bureau of Reclamation, Pacific Northwest Region

Bureau of Reclamation, Technical Service Center, Denver, Colorado

Digitized by the Internet Archive
in 2012 with funding from
LYRASIS Members and Sloan Foundation

http://archive.org/details/valueplanningfin002001

Table of Contents

Executive Summary 1

Value Study Team Members 3

Acknowledgment of Design Team and Consultant Assistance 4

Value Method Process 4

Current Description 5

Figure 1. Location Map 7

Figure 2. Alternative 2 (Preferred in 75-Percent Concept) 8

Owner, Users, and Stakeholders List 9

Function Analysis 10

Function Analysis System Technique (FAST) 10

Proposal No. 1. Enhance Communication and Transfer of Critical Project Information and Proposals Among the Elwha Watershed Restoration Project Teams. 13

Proposal No. 2. Modify Elwha Dam and Glines Canyon Dam Removal Schedule 15

Figure 3. Fish Migration Schedule 17

Proposal No. 3. Dam Removal With Low-level Ungated Outlet for Sediment Release Control 18

Proposal No. 4. Dam Removal Using Low-level Gated Outlet for Sediment Release Control 20

Proposal No. 5. Replace Preferred Ranney Well Alternative (Planning Team Alternative 2) With Well Points. 22

Proposal No. 6. Pre-sedimentation Basin in Place of an Infiltration Gallery 24

Figure 4. Plan View of Sedimentation Basin 26

Proposal No. 7. Replace Chemical Treatment With Slow Sand Filtration 27

Figure 5. Plan of Slow Sand Filter 29

Figure 6. Section of Slow Sand Filter 30

Proposal No. 8 Five-Year Design Life Treatment Plant Versus "Permanent" Treatment Plant. 31

Table 8.1 - Comparison of Alternative Costs 33

Figure 7. Plan View of Temporary Plant 35

Figure 8. Hydraulic Flocculation 36

Proposal No. 9. Replace Ranney Collectors in Alternative No. 2 With Horizontal Wells . . . 37

Disposition of Ideas 39

List of Consultants 41

Data and Documents Consulted 41

Design Team Presentation Attendance List 43

Value Study Team Presentation Attendance List 45

APPENDIX 47

Executive Summary

The Value Study Team met on February 5, 2001, for a 5-day study of the Elwha River Water Quality Mitigation Project, 75-percent concept developed by URS, a consultant for USBR. USBR, in turn is providing design support through an interagency agreement to the National Park Service. The National Park Service is the lead agency for the Federal Government for this project. Value Planning studies were completed for the 10-percent concept (October 10, 2000) and the 50-percent concept (November 14, 2000). The estimated cost of Alternative 2, the preferred 75-percent concept (the baseline for this report) is $52,729,000. The Team developed nine proposals which are summarized below. If all the avoidances proposals are accepted, their maximum avoidances potential is $30,000,000. Note that in calculating the maximum potential avoidances, the cost of the study ($25,000) was deducted once.

The Elwha River Water Quality Mitigation Project is closely linked with the Elwha and Glines Canyon Dams Removal Project and projects to address flood control, all in support of fisheries restoration. Changes in the design of one project may significantly impact design of the other projects.

The proposals are generally independent of each other. Several could be accepted or rejected individually without affecting other proposals. For example, Proposal Nos. 1, 2, 3 (or 4), 5, and 9 could be combined for increased avoidances. However Proposal Nos. 3 and 4 would not be combined.

Proposal No. 1. Enhance Communication and Transfer of Critical Project Information and Proposals Among the Elwha Watershed Restoration Project Teams. The monetary benefits of this proposal have not been estimated, but may be substantial. Non-monetary benefits include improved overall performance, timeliness, and efficiency for the habitat restoration and related projects.

Proposal No. 2. Modify Elwha and Glines Canyon Dam Removal Schedule. The estimated avoidances of this proposal are $17,576,000 before deducting any study and/or implementation costs.

Proposal No. 3. Dam Removal With Low-level Ungated Outlet for Sediment Release Control. The estimated avoidances of this proposal are $14,077,500 before deducting any study and/or implementation costs. Non-monetary benefits include improved overall performance, timeliness, and efficiency for the habitat restoration and related projects.

Proposal No. 4. Dam Removal Using Low-level Gated Outlet for Sediment Release Control. The estimated avoidances of this proposal are $12,077,500 before deducting any study and/or implementation costs. Non-monetary benefits include improved overall performance, timeliness, and efficiency for the habitat restoration and related projects.

Proposal No. 5. Replace Preferred Ranney Well Alternative (Planning Team Alternative 2) With Well Points. The estimated avoidances of this proposal are $29,155,000 before deducting any study and/or implementation costs.

Proposal No. 6. Pre-sedimentation Basin in Place of an Infiltration Gallery. The estimated avoidances of this proposal are $23,700,000 before deducting any study and/or implementation costs.

Proposal No. 7. Replace Chemical Treatment With Slow Sand Filtration. The estimated avoidances of this proposal are $4,850,000 before deducting any study and/or implementation costs.

Proposal No. 8. Five-Year Design Life Treatment Plant Versus "Permanent" Treatment Plant. The estimated avoidances of this proposal are $15,477,000 before deducting any study and/or implementation costs.

Proposal No. 9. Replace New Ranney Wells (Alternative 2) with Horizontal Wells. The estimated avoidances of this proposal are $29,155,000 before deducting any study and/or implementation costs.

Other Ideas: The Team identified 16 additional ideas for further consideration and development that are listed in the "Disposition of Ideas" table near the end of this report.

Value Study Team Members

Name/Title/Discipline	Address/Phone Number
Norm Hyndman Value Study Team Leader General Engineer	Bureau of Reclamation, Technical Service Center PO Box 25007 (D-8170), Denver CO 80225-0007 Phone: 303-445-3251 FAX: 303-445-6475 E-mail: nhyndman@do.usbr.gov
Frank Leitz Chemical Engineer	Bureau of Reclamation, Technical Service Center PO Box 25007 (D-8230), Denver CO 80225-0007 Phone: 303-445-2255 FAX: 303-445-6329 E-mail: fleitz@do.usbr.gov
Keith Copeland Cost Estimator (Part-time Member)	Bureau of Reclamation, Technical Service Center PO Box 25007 (D-8170), Denver CO 80225-0007 Phone: 303-445-3079 FAX: 303-445-6475 E-mail: kcopeland@do.usbr.gov
Gary Rosenlieb Hydrologist, Water Quality Coordinator	National Park Service, 1201 Oakridge Drive, Suite 250, Fort Collins, CO 80525 Phone: 970-225-3518 FAX: 970-225-9965 E-mail: gary_rosenlieb@nps.gov
Ken Hartz Senior Treatment Engineer Consultant to USBR	URS Corporation 25702 75th Avenue SW, Vashon, WA 98070 Phone: 206-463-6667 FAX: 206-463-6671 E-mail: hartz2000@msn.com
Tim Volz Regional Water Resources Director Consultant to USBR	URS Corporation 8415 Explorer Dr, Suite 110, Colorado Springs, CO 80920 Phone: 719-533-7845 FAX: 719-531-0007 E-mail: tim_volz@urscorp.com
Stephen Sperr Utility Engineer	City of Port Angeles 321 East 5th Street, Port Angeles, WA 98362 Phone: 360-417-4821 FAX: 360-417-4709 E-mail: utilengr@ci.port-angeles.wa.us
Mark Carlson Consultant to the City of Port Angeles	CH2M Hill 2300 NW Walnut Boulevard, Corvallis, OR 97330 Phone: 541-7524271 FAX: 541-752-0276 E-mail: MCarlso1@CH2M.com
Dennis Gathard Engineering Consultant to the Lower Elwha Klallam	GEC 3829 Burke Avenue North, Seattle, WA 98103 Phone: 206-547-4148 Fax: 206-547-4052 E-mail: dgathard@riveresources.com

Acknowledgment of Design Team and Consultant Assistance

The Value Study Team wishes to express their thanks and appreciation to the Design Team Leader, Ms. Ellen Abart, and the members of the design team, who fully and cordially provided all requested information and consultation on the conceptual design. The team would not have been as successful without the design team's cooperation and assistance.

The Value Study Team wishes also to express thanks and appreciation to those listed on the Consultation Record of this report. Their cooperation and help contributed significantly to the technical foundation and scope of the team's investigation and final proposals.

The goal of the value method is to achieve the most appropriate and highest value solution for the project. It is only through the effort of a diverse, high performing team, including all those involved, that this goal can be achieved. This study is the product of such an effort.

Value Method Process

The Value Method is a decision making process, originally developed in 1943 by Larry Miles, to creatively develop alternatives that satisfy essential functions at the highest value. It has many applications but is most often used as a management or problem-solving tool.

The study process follows a Job Plan that provides a reliable, structured approach to the conclusion. Initially, the team examined the component features of the program, project or activity to define the critical functions (performed or desired), governing criteria, and associated costs. Using creativity (brainstorming) techniques, the team suggested alternative ideas and solutions to perform those functions, consistent with the identified criteria, at a lower cost or with an increase in long term value. The ideas were evaluated, analyzed and prioritized, and the best ideas were developed to a level suitable for comparison, decision making and adoption.

This report is the result of a "formal" Value Study, by a team comprised of people with the diversity, expertise, and independence needed to creatively attack the issues. The team members bring a depth of experience and understanding of the discipline they represent, and an open and independent enquiry of the issues under study, to creatively solve the problems at hand. Ideally, the team members have not been notably involved in the issues prior to the study. The team applied the Value Method to the issues and supporting information, and took a "fresh look" at the problems to create alternatives that fulfill the client's needs at the greatest value.

Current Description

The Elwha Act, PL 102-495, calls for full restoration of the ecosystem and habitat for anadromous species in the Elwha River watershed, including deconstruction of the Elwha and Glines Canyon Dams. As the dams are removed (short-term), the entrapped sediments will be released in high concentration periods, as notches are cut lower and lower in the dams. During these high concentration periods the sediments will "pulse" through the lower reaches of the Elwha River. After dam removal, the sediment load (long-term) in the river is expected to return to natural pre-dam levels. Both short-term and long-term sediment loads will reach the intakes for the City of Port Angeles municipal and industrial supplies and fisheries (hatcheries) for both Washington State and the Lower Elwha Klallam Indian Tribe, among other water users. See Figure 1.

The Elwha River Water Quality Mitigation Project is intended to reduce or eliminate the adverse impacts of short-term and long-term sediment loads, as well as other water quality impacts, to the downstream water users. The 75-percent concept was developed by URS, a consultant for U.S. Bureau of Reclamation (USBR). USBR, in turn is providing design support through an interagency agreement to the National Park Service. The National Park Service is the lead agency for the Federal Government for this project. The October 10, 2000, value planning report for the 10-percent concept development and the November 14, 2000 value planning report for the 50-percent concept development provide additional project background.

The design flows assumed by the 50-percent concept development in million gallons per day (mgd) and cubic feet per second (cfs) are:

Port Angeles Municipal,	10.6 mgd	(16.4 cfs);
Daishowa (industrial),	20.0 mgd	(31.0 cfs);
WDFD Fish Rearing Channel,	21.3 mgd	(33.0 cfs);
Lower Elwha Klallam Tribe Fish Hatchery	17.4 mgd	(27.0 cfs);
Port Angeles reserve industrial rights	44.5 mgd	(69.0 cfs);
TOTAL	113.8 mgd	(176.4 cfs)

The 75-percent concept development considers four alternatives and prefers Alternative 2. All alternatives assume addition of a treatment plant in conjunction with the existing Ranney Well to provide municipal water supply. The estimated cost of this common part of the alternatives is $17,212,998 construction cost (or $20,655,598, including a 20-percent factor for engineering, survey and construction management). Alternative 2 provides industrial and fisheries water supplies through six new Ranney wells for an estimated cost of $26,796,000 construction cost, or $32,155,000 total cost. The cost for Alternative 2 is $52,729,000. None of the alternatives provides for treatment for the reserve industrial rights.

Alternative 2 provides both industrial and fisheries water by construction of six new Ranney wells sized for a total of 58 mgd. See Figure 2. The value study team initially considered

Current Description

three concerns with this approach, site suitability, salt water intrusion (aquifer capacity), and sunk capital costs for a largely temporary need. A hydrogeology study should be completed in late March or early April, addressing some of these concerns, allowing a more definite assessment of the merits and limits of this alternative.

The study team questioned Tim Randle of the USBR, D-8540 about the duration and sediment loads during and after dam removal. He confirmed that the durations of high sediment loads are expected to be only 1 to 2 days, with one important exception. When the lowest 30 or so feet of Glines Canyon Dam is removed, the duration of high sediment loads (> 10,000 milligrams per liter (mg/L)) may last up to about 40 days.

Figure 1. Location Map

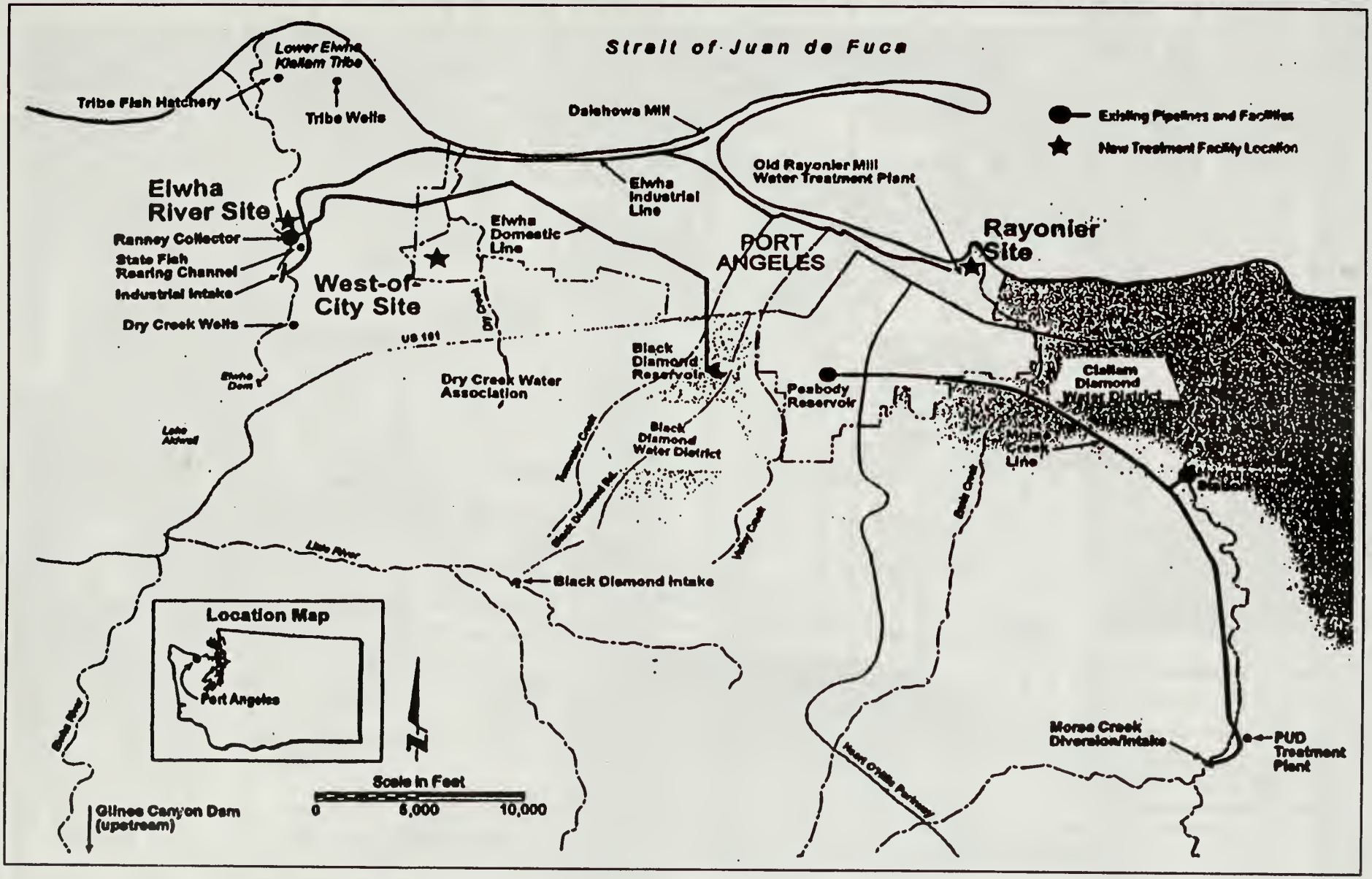
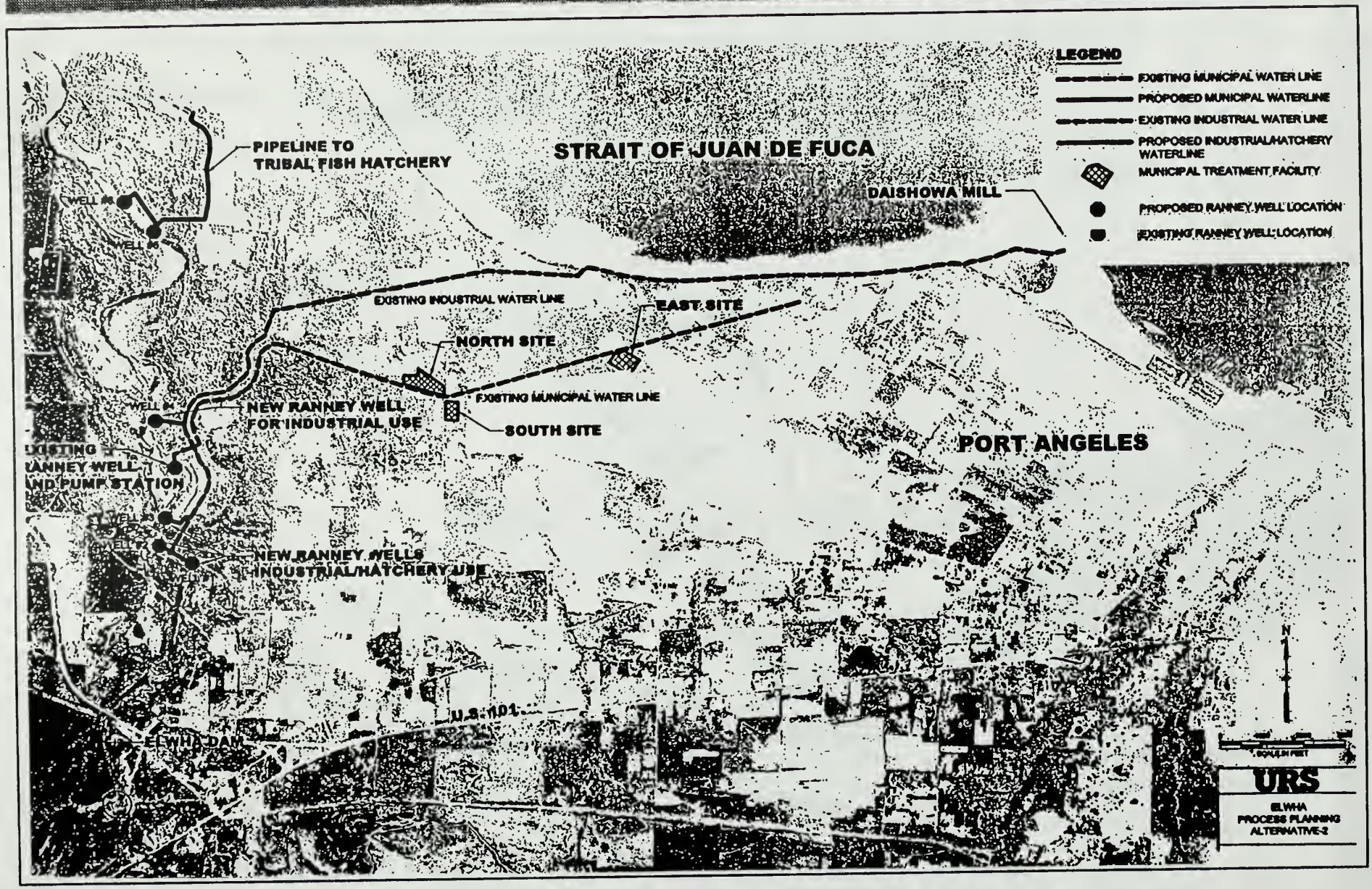


Figure 2. Alternative 2 (Preferred in 75-Percent Concept)



Owner, Users, and Stakeholders List

Identification and Issues Determination

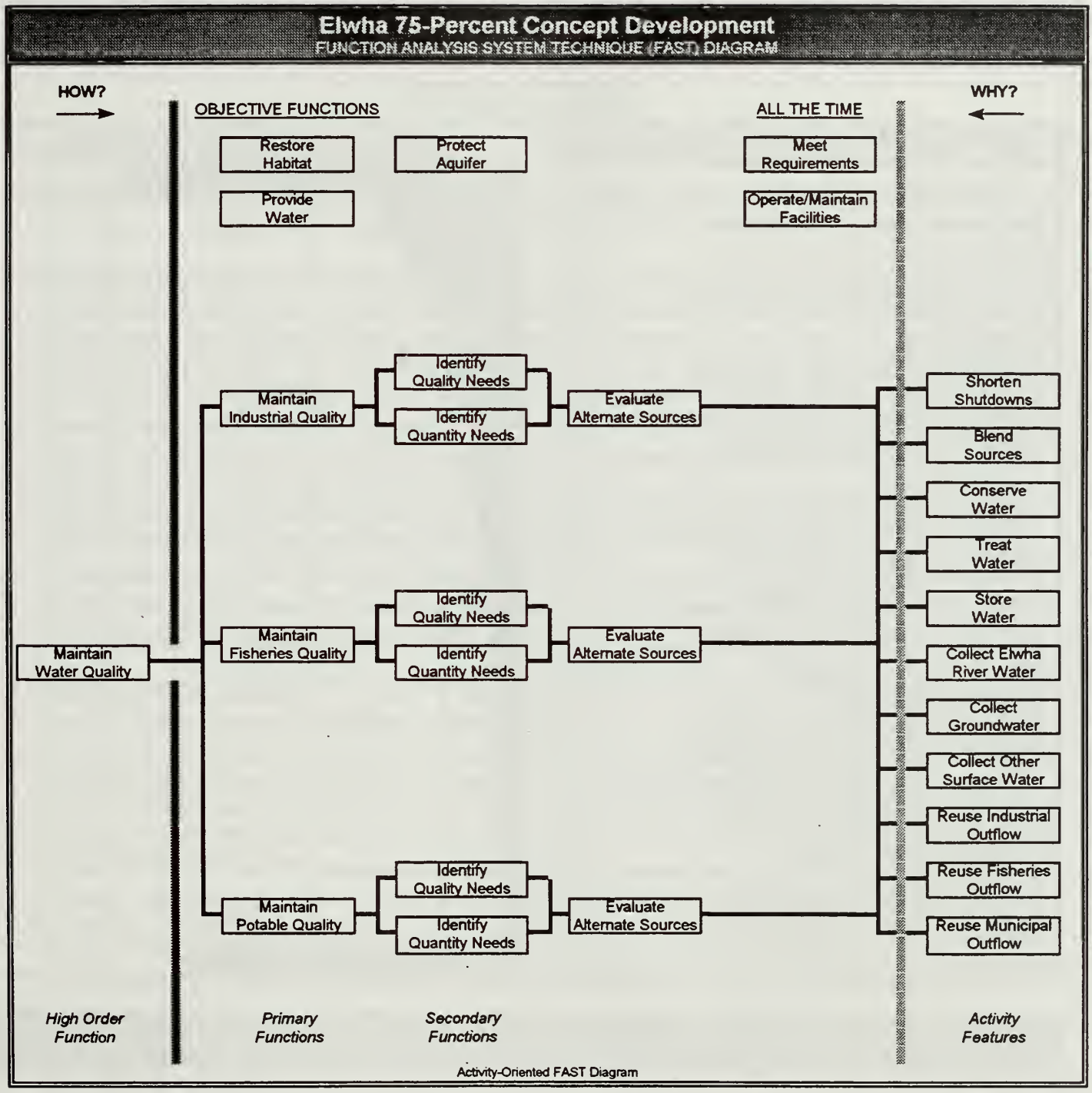
Owner (Identification of the owner or owners)	Owner Issues (Identification of issues important to every owner)	Desire/ Criteria
National Park Service	Anadromous Habitat Restoration Elwha Act Compliance	C C
User (Identification of the user or users)	**User Issues** (Identification of issues important to every user)	**Desire/ Criteria**
City of Port Angeles	Maintenance of water quality and supply Operations and Maintenance Effort/Cost groundwater under influence (GWI) of surface water compliance	C C, D C
Daishowa Mill	Industrial water quality and supply Operations and Maintenance Effort/Cost	C C, D
Lower Elwha Klallam Tribe	Fishery water quality and supply Anadromous Species Habitat	C C
Washington State Department of Fish and Wildlife	Fishery water quality and supply Anadromous Species Habitat	C C
Dry Creek Water Association, Elwha Place Water Association	Water quality and supply	C
Stakeholder (Identify of the stakeholder or stakeholders)	**Stakeholder Issues** (Identification of issues important to every stakeholder)	**Desire/ Criteria**
Washington State Department of Health	Meet Drinking Water Regulations Approval of Project Plan	C C
Washington State Department of Ecology	Regulation, Water Rights	C
National Marine Fisheries Service	Anadromous Species Habitat	C, D
U.S. Fish and Wildlife Service	Anadromous Species Habitat	C, D
Elwha Morse Management Team	Restoration	C, D
Clallam County	Permitting	C
Public	Water Quality and Supply Anadromous Species Habitat Local Economy	D D D

Function Analysis

Component	Active Verb	Measurable Noun
Elwha Act	Restore	Habitat
Project	Mitigate	Sediment Effects
Intake Structure	Supply	Water
	Exclude	Coarse Sediments
Ranney Well	Supply	Water
	Exclude	Coarse Sediments
Channel/Pipeline/Tunnel	Transport	Water
Treatment Facility	Clean	Water
Reservoir	Store	Water
Conservation	Reduce	Use/Demand
Recycling	Reuse	Water
Blending	Control	Quality
	Stretch	Supply
Sediment Model	Establish	Criteria
Design Criteria	Direct	Design Effort

Function Analysis System Technique (FAST)

The Value Study Team used the function-analysis process to generate a Function Analysis System Technique (FAST) diagram, designed to describe the present solution from a functional point of view. The FAST diagram helped the Team identify those design features that support critical functions and those that satisfy noncritical objectives. The FAST diagram also helped the Team focus on potential value mismatches, and generate a common understanding of how project objectives are met by the present solution.


Elwha 75-Percent Concept Development
FUNCTION ANALYSIS SYSTEM TECHNIQUE (FAST) DIAGRAM
HOW?
OBJECTIVE FUNCTIONS
ALL THE TIME
WHY?
Restore Habitat
Protect Aquifer
Meet Requirements
Provide Water
Operate/Maintain Facilities
Maintain Industrial Quality
Identify Quality Needs
Identify Quantity Needs
Evaluate Alternate Sources
Maintain Fisheries Quality
Identify Quality Needs
Identify Quantity Needs
Evaluate Alternate Sources
Maintain Water Quality
Maintain Potable Quality
Identify Quality Needs
Identify Quantity Needs
Evaluate Alternate Sources
Shorten Shutdowns
Blend Sources
Conserve Water
Treat Water
Store Water
Collect Elwha River Water
Collect Groundwater
Collect Other Surface Water
Reuse Industrial Outflow
Reuse Fisheries Outflow
Reuse Municipal Outflow
High Order Function
Primary Functions
Secondary Functions
Activity Features
Activity-Oriented FAST Diagram

Alternative 2, Elwha River Water Quality Mitigation Project

VALUE STUDY

COST MODEL

COMPONENT/PERCENT PROJECT COST		PROJECT COST PROPORTION
Construct Six Ranney Wells	(24.9%)	
Elec/Instr/Controls for Ranney	(8.4%)	
Mob/Demob /Bonds for Ranney	(7.0%)	
Elec/Instr/Controls for Treatment	(5.9%)	
Plate Settlers	(3.8%)	
Mob/Demob/Bonds for Treatment	(3.8%)	
Floc/Sed/Operations Complex	(3.2%)	
Diesel Backup Power, Ranney	(2.9%)	
Pipeline to Tribe	(2.7%)	
Vertical Turbine Pumps, Ranney	(2.5%)	
Clearwell Station, Treatment	(2.3%)	
Preliminary Geologic Report	(2.3%)	
Isolation Valves/Fittings, Ranney	(1.4%)	
Filter Complex, Treatment	(1.2%)	
HVAC for Treatment	(1.1%)	
Excavation Floc/Sed, Treatment	(1.1%)	
WW Recovery Basin, Treatment	(1.0%)	
Motor Control Center, Ranney	(1.0%)	
Concrete, Ranney wells	(1.0%)	
Backfill Floc/Sed, Treatment	(0.9%)	
U/drain, Filter Complex, Treatment	(0.9%)	
All Other Items	(20.8%)	

COST MODEL AND ESTIMATE INFORMATION

The Value Study Team cost model is based on the conceptual design estimates provided by the design team for the preferred project design. The cost model was developed by the Value Study Team and was used to focus on features with the greatest potential for savings and to highlight areas of value mismatch. Unit prices were reviewed by the Cost Estimator and Value Study Team members, to ensure reliability and applicability.

Cost avoidances/savings and the original design concept estimates are of the same general level of development, although these costs may vary as final designs are pursued.

Proposal No. 1

Description

Proposal No. 1. Enhance Communication and Transfer of Critical Project Information and Proposals Among the Elwha Watershed Restoration Project Teams.

- Proposal Description: The Value Study Team (VST) proposes that a central project coordination team be established for the purpose of enhancing communication of real-time information regarding the project status of major issues associated with the major project components (i.e. dam removal, flood control, water quality mitigation, sediment management and fisheries management.) The team would consist of one representative from each of the planning and implementation teams. This team would facilitate information exchange through periodic meetings when changes in scheduling or project infrastructure occurred. The VST believes that an initial meeting should be held within the next month which would convene key planning team members from each issue team who would present summaries of the current status of their respective team's proposals and what changes may occur within the immediate future. We also recommend that an e-mail tree of project team members be established so that the dates of individual team meetings may be widely broadcast and members of other teams may be invited.

- Critical Items to Consider: The VST is aware of at least five funded issue teams working on the Elwha Watershed Restoration Project, at this time. These include teams working on dam removal, flood mitigation, sediment management, water quality mitigation, and fisheries management issues. Project planning efforts within these groups appear to be highly compartmentalized, with little communication of major project thrusts and amendments of each team disseminated among the groups. The VST strongly feels that this is resulting in contradictory and conflicting project proposals that may not be optimized for the overall project. For example, a dam removal schedule has been established to accommodate the migration, spawning and capture needs for anadromous fish. The resulting schedule may implement the final dam-removal phase, and associated high Elwha River sediment concentrations, during April and May which coincides with the peak industrial water demands. Water-quality treatment costs could be reduced significantly if the last phase of dam removal could be initiated in December and January when industrial water supply needs are minimal (See more detailed discussion in Proposal No. 2). The VST is also aware of a potential crosscutting issue between the water quality and flood mitigation teams related to the management of septic-system leach field response to increased flood levels and/or increased use of groundwater.

- Ways to Implement: As described in this Proposal Description, several methods of mass communication, including meetings and electronic communication, may be used.

- Changes from the Baseline Concept: This does not exist in the baseline concept at this time.

Proposal No. 1

Advantages	Disadvantages
• Increased probability of optimizing project designs for the overall project. • Rapid inter-team transfer of critical data and information.	• None apparent.

Potential Risks
None apparent.

Cost Items	Nonrecurring Costs
Original Baseline Concept	not developed
Value Concept	not developed
Avoidance	$ 0
Value Study Costs	$ 25,000
Implementation Costs	$ 0
Net Avoidances	**$ (25,000)**

Proposal No. 2

Description

Proposal No. 2. Modify Elwha Dam and Glines Canyon Dam Removal Schedule.

- Proposal Description: As one of the benefits of Proposal No. 1, the VST recommends a further review of the schedule for removing the last 30 feet of the Glines Canyon and Elwha Dam.

- Critical Items to Consider: The industrial water quality mitigation facilities will be designed to handle the anticipated demands particularly during the removal of the remaining 30 feet of the dams. The removal of the last 30 feet has been shown by the USBR sediment models to have one of the highest sediment loads in the river with the highest coming from the first significant runoff event after dam removal. Because of the watershed characteristics, the later event is expected to occur over a very short time frame (about 20 days) as noted in previous study proposals. The VST recommends that a coordinated effort between removal of the dams will assist in minimizing the size of industrial facilities needed to maintain an acceptable water quality during critical times of high sediment loads in the Elwha River.

As shown below, the industrial water demands have been updated and provided by the respective entities. Daishowa has provided both an average annual day (AAD) and maximum day (MD) demand as shown below. The industrial water demands appear to be at their lowest during the months of January, February, March, July, November, and December.

INDUSTRIAL WATER DEMANDS

MONTH	WDFW (cfs)	TRIBE (cfs)	DAISHOWA (AAD/MD) (cfs)	TOTAL (AAD/MD) (cfs)
JAN	**1.0**	**12.6**	**14/21.7**	**27.6/35.3**
FEB	**9.7**	**19.1**	**14/21.7**	**42.8/50.5**
MAR	**14.1**	**21.4**	**14/21.7**	**49.5/57.2**
APR	20.6	26.1	14/21.7	60.7/68.4
MAY	31.1	28.8	14/21.7	73.9/81.6
JUN	36.1	2.9	4/21.7	53.0/60.7
JUL	**5.0**	**3.5**	**14/21.7**	**22.5/30.2**
AUG	33.0	4.3	14/21.7	51.3/59.0
SEP	33.0	5.3	14/21.7	52.3/60.0
OCT	33.0	6.5	14/21.7	53.5/61.2
NOV	**1.0**	**8.3**	**14/21.7**	**23.3/31.0**
DEC	**1.0**	**10.5**	**14/21.7**	**25.5/33.2**

The fish migration schedule (See Figure No. 3), indicates a window of opportunity of removing the lower 30 feet of the Elwha and Glines Canyon Dams concurrently with low industrial water demands (November through March). During these months, the Elwha River watershed will typically experience high runoffs which also assist in quickly removing the reservoir sediments.

Proposal No. 2

- Ways to Implement: The Dam Removal, Flood Mitigation, Fishery and Water Quality Mitigation committees need to review the advantages and disadvantages to adjusting the schedule. Some preliminary advantages and disadvantages are shown below.

- Changes from the Baseline Concept: Based on the Year 1 Proposed Removal schedule (attached), the remaining demolition schedule commences January 1 and continuing until complete removal. This proposal recommends that the schedule be adjusted to begin in November or December to provide the maximum amount of time for high sediment loading during low industrial demands. The lower 30 feet of the dam needs to be removed within a relatively short time frame to take advantage of flushing flows.

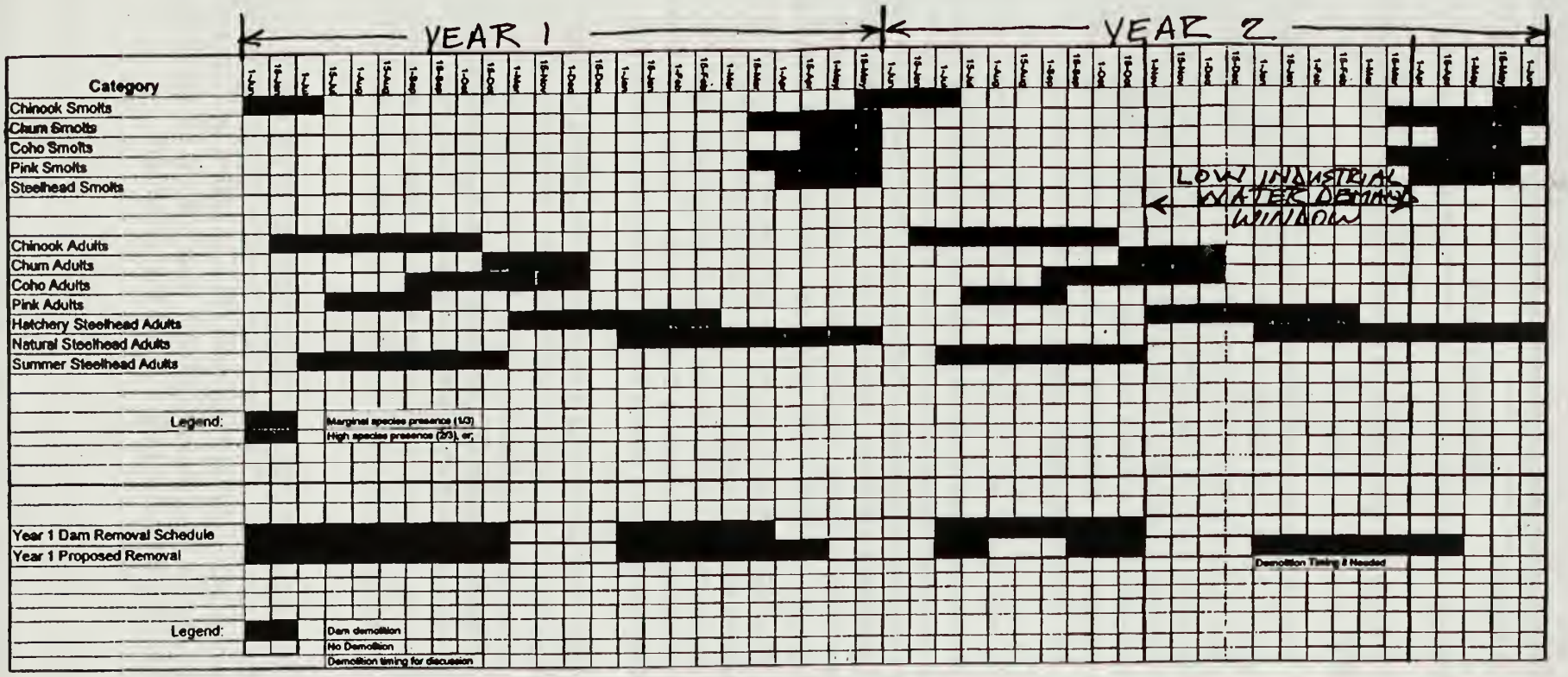
Advantages	Disadvantages
• Minimizes facilities and treatment cost to keep industrial users whole during short periods of high sediment loads for any treatment alternative. • Removal occurs during a period of high rainfall/snowfall events to allow for flushing flows to occur. • Provides the ability to control when the second highest sediment load occurs.	• May increase the impacts on current fish runs. • May require a different dam removal method for the lower 30 feet. • Flushing flows may not occur and therefore increase risk at a future date of meeting industrial water demands. • Further flood mitigation facilities may be required.

Potential Risks

- None noted.

Cost Items	Nonrecurring Costs
Original Baseline Concept, Alternative 2	$ 52,729,000
Value Concept , say 2/3 of Alternative 2	$ 35,153,000
Avoidance	$ 17,576,000
Value Study Costs	$ 25,000
Implementation Costs	$ 0
Net Avoidances	**$ 17,551,000**

Figure 3. Fish Migration Schedule



Proposal No. 3

Description

Proposal No. 3. Dam Removal With Low-level Ungated Outlet for Sediment Release Control.

- Proposal Description: This proposal would provide more control over sediment release timing. The proposal would coordinate timing of the removal of the last portion of the dams, which produce the highest concentration of suspended sediment, so that both occur during winter high-flow periods which provide the greatest sediment transport capability. Winter flows also provide the highest probability of removing large quantities of material and reducing subsequent suspended sediment concentrations which could occur during higher water withdrawal demand periods. Releasing the highest sediment concentrations during winter also coincides with the lowest water withdrawal demand period for the year.

  This alternative would create a low-level outlet by blasting an opening in the base of Glines Canyon dam simultaneously with opening the lowest portion of Elwha dam during the winter high-flow period. This approach would allow the river to quickly establish a new channel. Subsequent high flows that would increase channel size and create high turbidity would more likely occur in following winter high flows; reducing the impacts during low flow periods. High flows could occur at any time, however causing future high turbidity events which could coincide with high-water use demand. This approach would reduce the probability of future high turbidity flows during high demand but not completely eliminate the possibility. To better control future high turbidity and decrease risks associated with proposed downsized water treatment facilities, this proposal would use sluicing of bank material during high-flow immediately after initial flushing to increase channel size. Future high-flow events would cause increased turbidity but at lower levels than if slucing were not used.

- Critical Items to Consider: This alternative should consider means to concentrate the removal of fine sediment into high-flow low-water demand periods. Dredging, sluicing, and other methods which could allow for an overall decrease in water protection facility size should be considered. Methods of controlling the timing and amount of sediment release which could be affected by methods of dam removal should be considered. Methods of sediment removal such as sluicing or dredging material to increase erosion rates in low-water use periods should be considered in conjunction with controlling sediment release to avoid critical fish passage timing.

- Ways to Implement: This approach would involve redesign of the methods of dam removal to allow control of sediment releases. The approach could be implemented by increasing the rate during removal of the lower parts of the dam. Constructing an outlet at Glines Canyon Dam where the majority of the sediment is located would allow for rapid drawdown of the reservoir and establishment of a river way through the sediment.

Proposal No. 3

Advantages	Disadvantages
• Reduction in needs to treat water withdrawn from river and associated reduction in cost of water quality mitigation facilities. • Lower risks associated with river water turbidity at later periods when usage demand and impacts to fisheries is high. • Better water quality during most of the remaining year and especially during high-water usage periods.	• Potentially higher costs for dam and sediment removal. • Difficulty constructing ungated low-level outlet. • Requires monitoring of outlet to ensure it stays open.

Potential Risks

Dredging during high-flow periods. Construction of low-level outlet.

Cost Items	Nonrecurring Costs
Original Baseline Water Quality Mitigation	$ 32,155,000
Value Concept*	$ 18,077,500
Avoidance	$ 14,077,500
Value Study Costs	$ 25,000
Implementation Costs	$ 0
Net Avoidances	**$ 14,052,500**

*Industrial treatment equals one-half of Alternative 2 = $16,077,500; Dam removal = $2,000,000

Proposal No. 4

Description

Proposal No. 4. Dam Removal Using Low-level Gated Outlet for Sediment Release Control.

- Proposal Description: This proposal would provide more control over sediment release timing. Similar to Proposal No. 3, this proposal would coordinate timing of the removal of the last portion of the dams, which produces the highest concentration of suspended sediment, so that both occur during winter high-flow periods providing the greatest sediment transport capability. Winter flows provide the highest probability of removing large quantities of material and reducing subsequent suspended sediment concentrations which could occur during higher water withdrawal demand periods. Releasing the highest sediment concentrations during winter also coincides with the lowest water withdrawal demand period for the year. To better control future high turbidity and decrease risks associated with proposed downsized water treatment facilities, this proposal would use dredging of bank material during high flow immediately after initial flushing to increase channel size. Dredging would widen the channel to the 100-year flood event width. After initial opening of the low-level outlet, water levels would be raised again so that dredges could widen the channel to the 100-year flood event width. Future high-flow events would cause increased turbidity but at lower levels than if dredging were not used.

  This proposal would construct a low-level gated outlet at the base of Glines Canyon Dam to control sediment release from this dam. Initial sediment impacts of releases from Elwha Dam would remain the same. Release of the major portions of sediment from both dams would occur during late December through early February. Sediment release would primarily occur during high river flow/low-water demand months. The low-level outlet at Glines would lower the reservoir by approximately 35-40 feet rapidly in conjunction with removing the last portion of the Elwha Dam and releasing the largest sediment flows from Lake Mills. A similar concept would be developed to control the release of sediment at Elwha Dam.

- Critical Items to Consider: Methods of controlling the timing and amount of sediment release. Methods of dam removal. Methods of sediment removal such as sluicing after opening low-level outlet or dredging material before opening low-level outlet to increase erosion rates in low-water use periods. Controlling sediment release to avoid critical fish passage.

- Ways to Implement: This approach would involve redesign of the methods of dam removal to allow control of sediment releases. The approach could be implemented by increasing the rate during the lower parts of dam removal. Constructing a gated outlet at Glines Canyon Dam where the majority of the sediment is located would allow for rapid drawdown of the reservoir and establishment of a river way through the sediment. Removing additional sediment up to the 100-year flood condition could be accomplished by re-elevating the reservoir and dredging remaining material or using sluicing equipment to remove river bank material.

Proposal No. 4

- Changes from the Baseline Concept: Changes from the baseline concept would include coordination of dam removal and sediment release timing to create largest sediment releases during the low demand high-flow periods from November through February. Changes in construction techniques may include constructing gated low-level outlets, dredging, and changes to cofferdam designs at Elwha Dam.

Advantages	Disadvantages
• Reduction in the quantity of treated water withdrawn from river and associated reduction in cost of water quality mitigation facilities. • Lower risks associated with river water turbidity at later periods when usage demand and impacts to fisheries is high. • Better water quality during most of the remaining year and especially during high-water usage periods.	• Potentially higher costs for dam and sediment removal. • Difficulty constructing gated low-level outlet.

Potential Risks

Clogging of outlet. This could be averted by monitoring and blasting techniques

Cost Items	Nonrecurring Costs
Original Baseline Water Quality Mitigation	$ 32,155,000
Value Concept *	$ 20,077,500
Avoidance	$ 12,077,500
Value Study Costs	$ 25,000
Implementation Costs	$ 0
Net Avoidances	**$ 12,052,500**

*Industrial treatment equals one-half Alternative 2 = $16,077,500; Dam removal = $4,000,000

Proposal No. 5

Description

Proposal No. 5. Replace Preferred Ranney Well Alternative (Planning Team Alternative 2) With Well Points.

- Proposal Description: Use multiple well points along both sides of river for industrial water withdrawal.

  This alternative would construct four lines of well points, two lines on each side of the river. Each well point would withdraw approximately 20 gpm. To provide 90 cfs approximately 2,000 well points would be required. A steel beam bridge would be used to provide a river crossing for two lines. The remaining two lines would be located on the east side of the river. The existing head box would be used as the distribution system. Distribution of water to the Washington Department of Fish and Wildlife (WDFW), industrial pipe, and Tribal water supply systems would be similar to Alternative 2. Location of the well points would be near the proposed infiltration gallery and WDFW rearing facility.

  Well points would be about 10 to 15 feet long placed as close to the river as possible and be spaced roughly on 2-foot centers. System operation would require electrical supply with backup generation capability. It is assumed that well points would be used only when river water turbidity increases beyond tolerable levels. Each of the four lines would be capable of independent operation and could be used to provide cleaner water to be used with water diverted from the surface diversion. It is assumed that the surface diversion system would be in place and on line to be used as a parallel system when applicable. The pumping system would consist of four pumps, one for each line. Because of the infrequent use of the well point system each line would be individually controlled with manual controls.

- Critical Items to Consider: Timing of use. Pumping cost versus surface water flow costs. Mixing strategies to maximize surface water use. Optimum well point location. Aquifer transmisivity and well point production limits. Water quality of water withdrawn from well point system. Screen size and location. System salvage value. Need surface water diversion structure in conjunction with system.

- Ways to Implement: The system would be designed to provide required water quality and quantity for a 5-year design life. It would be installed prior to dam removal with the upgraded surface water diversion system.

- Changes from the Baseline Concept: Changes from the baseline concept would include constructing a well point system that replaces the function of the Ranney Collector system. The location of the well points would be near the river to ensure that water withdrawn was primarily river water so that impacts to the aquifer and groundwater would be minimized.

Proposal No. 5

Advantages	Disadvantages
• Reduction in the cost of system to provide water for industrial use. • Reduction in the potential for impacts to the aquifer from withdrawal of groundwater including possible impacts from saltwater intrusion. • Ease of installation. • Significantly reduced time for construction of system. • Flexibility of use for location and withdrawal depending on water use.	• Higher labor cost and possibly requiring full time operator for highest turbidity periods.

Potential Risks

Effects of high turbidity on clogging are unknown. Possible mitigation for this impact could include constructing additional well points either prior to operation or when yield is observed to decline.

Cost Items	Nonrecurring Costs
Baseline	$ 32,155,000
Value Concept	$ 3,000,000
Avoidance	$ 29,155,000
Value Study Costs	$ 25,000
Implementation Costs	$ 0
Net Avoidances	**$ 29,130,000**

Proposal No. 6

Description

Proposal No. 6. Pre-sedimentation Basin in Place of an Infiltration Gallery

- Proposal Description: Use an existing depression near the river and the State Fish Hatchery as a pre-sedimentation basin to reduce solids loading on the industrial treatment system. See Figure No. 4. A 6-foot berm would be constructed using stacked sand-bags. Water would be pumped from the existing head box. The water would exit the pre-sedimentation basin by gravity. Settled material will be removed using small flotation dredges. The basin would provide a surface loading rate of about 0.18 gallons per minute per square foot (gpm/sf)

- Critical Items to Consider: Sediment loading and type of solids being removed. The sedimentation basin is best at removing coarse sediment. The percentage of clay and silt in the sediment is unknown. The rough analysis suggests that there is enough land available to remove the silt-sized material. This alternative assumes that a diversion dam is in place. The tunnel leading to the header box must be kept clear of sediment.

- Ways to Implement: The alternative is used in place of the infiltration gallery to reduce the sediment load on the industrial water treatment system. This alternative could also be used as a chemical treatment system by adding a coagulant. Coagulant addition would increase solids removal and additional treatment may not be required. This alternative is only feasible for the use of surface water and is not feasible should groundwater be used as an industrial supply.

- Changes from the Baseline Concept: The infiltration gallery is replaced by the pre-sedimentation basin.

Advantages	Disadvantages
• Deposited sediment can be removed from the sedimentation basin. • The materials used for construction are easily disposed of after it is no longer needed. • The pre-sedimentation basin can continually operate. It will not plug even when sediment loading is high. • The facilities can be constructed relatively rapidly. • Low cost of construction.	• The basin is expected to remove about 50-percent of the total suspended solids (TSS) at 90 cfs flow. At 40 cfs, TSS removal will increase to 60-percent. • The depression will accumulate sludge and not be useable for a year or so after the water is removed. • The area may be a wetland area and there may be permit issues associated with flooding this depression. • The land needs to be purchased or leased.

Proposal No. 6

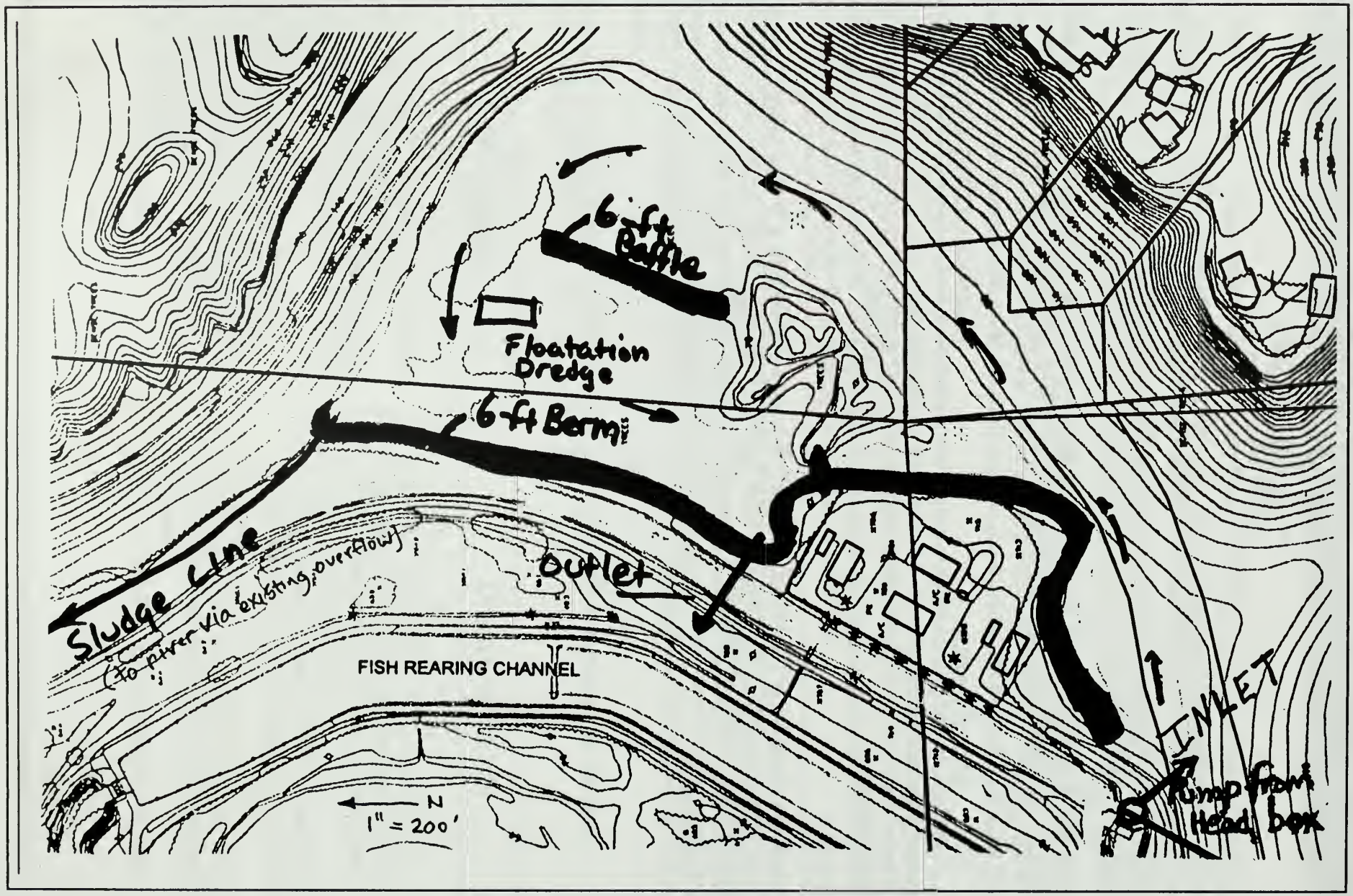
Potential Risks

The risks include feed pump failure that would restrict flow to the industrial users and dredge pump failure that would increase the TSS as previously deposited materials are scoured out. The depression is a natural system that has not been engineered for optimum solids removal and although guidelines from the Erosion and Sediment Control Handbook (see appendix of this document) were followed, the performance may vary from expectation.

The current owner of the land is a private citizen who may not be willing to lease the land required. If a coagulant is used, it may be difficult to dispose of the settled material.

Cost Items	Nonrecurring Costs
Original Baseline Concept	$ 26,000,000
Value Concept	$ 2,300,000
Avoidance	$ 23,700,000
Value Study Costs	$ 25,000
Implementation Costs, leasing of land	$ 50,000
Net Avoidances	**$ 23,625,000**

Figure 4. Plan View of Sedimentation Basin



Proposal No. 7

Description

Proposal No. 7. Replace Chemical Treatment With Slow Sand Filtration.

- Proposal Description: Slow sand filtration using feed from a pre-sedimentation basin and replacing the chemical treatment. See Figure Nos. 5 and 6.

- Critical Items to Consider: The rate of surface blinding, design filter loading rate, filter run length and maintenance effort required need to be determined. The need for pilot trials to confirm filtration rates and optimum filter configuration. This system is designed to treat 30 cfs of industrial water.

- Ways to Implement: Construct and use the slow sand filter in conjunction with an 8-acre pre-sedimentation basin, as a substitute for chemical treatment.

- Changes from the Baseline Concept: Eliminates the need for chemical treatment while producing relatively high clarity water that can be blended for each industrial use.

Advantages	Disadvantages
• Eliminates chemical contamination of removed solids and therefore sludge can be returned to the river, thus permitting delays may be avoided. • Produces high clarity water on a more reliable basis. • Eliminates operating costs of constant chemical addition. • Provides ability to produce clean water at anytime.	• Intermediate water quality needs must be met by blending. • Land requirements.

Potential Risks

Depending on filter location there may be a risk of flooding and loss of the system. Rapid blinding of the filter surface might reduce available output. Depending on management of the project, this investment may not be required.

Proposal No. 7	
Cost Items	**Nonrecurring Costs**
Original Baseline Concept (chemical treatment costs adjusted for 30 cfs)	$ 15,600,000
Value Concept (30 cfs)	$ 10,750,000
Avoidance	$ 4,850,000
Value Study Costs	$ 25,000
Implementation Costs	$ 1,000,000
Net Avoidances	**$ 3,825,000**

Figure 5. Plan of Slow Sand Filter

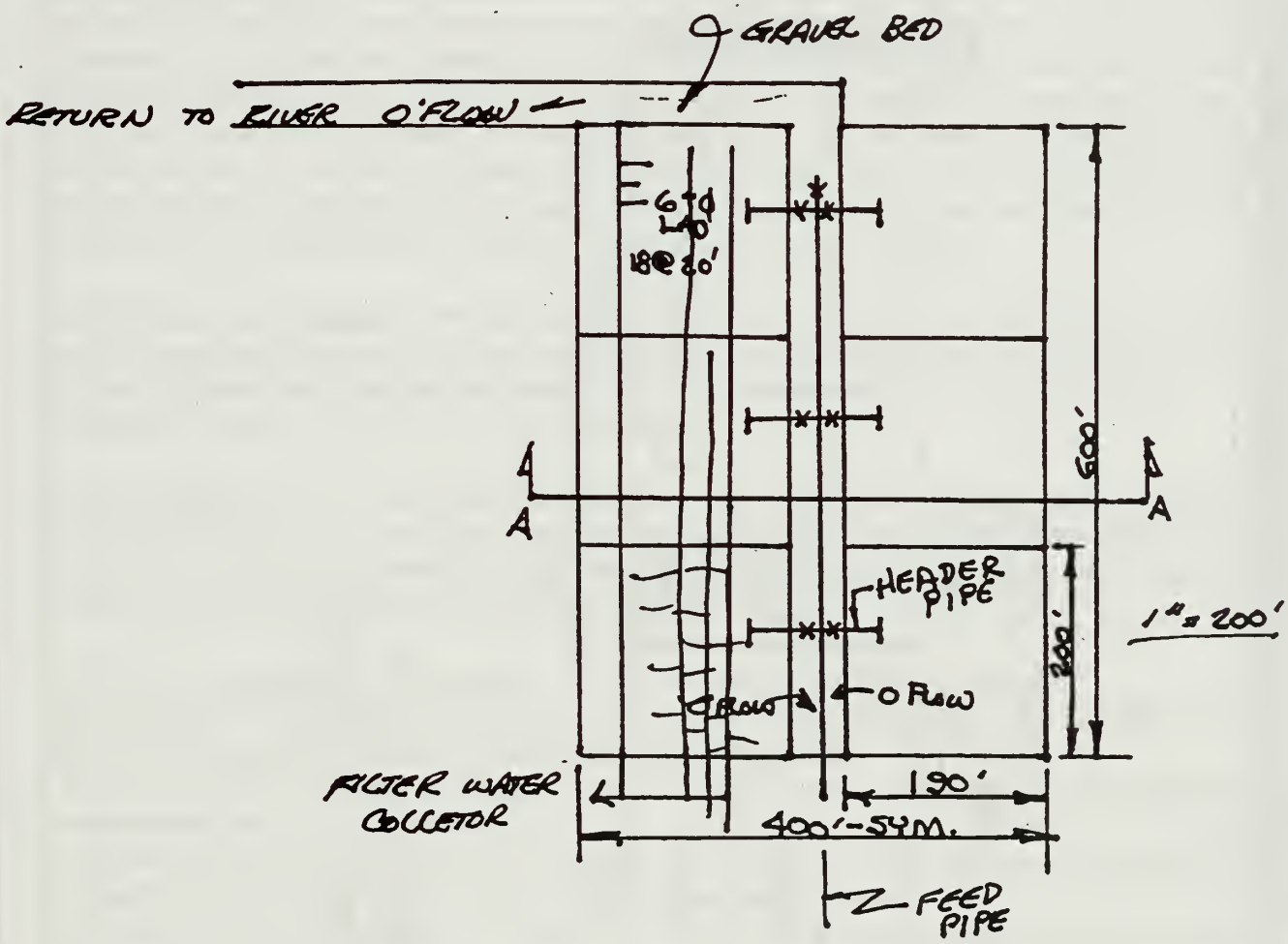
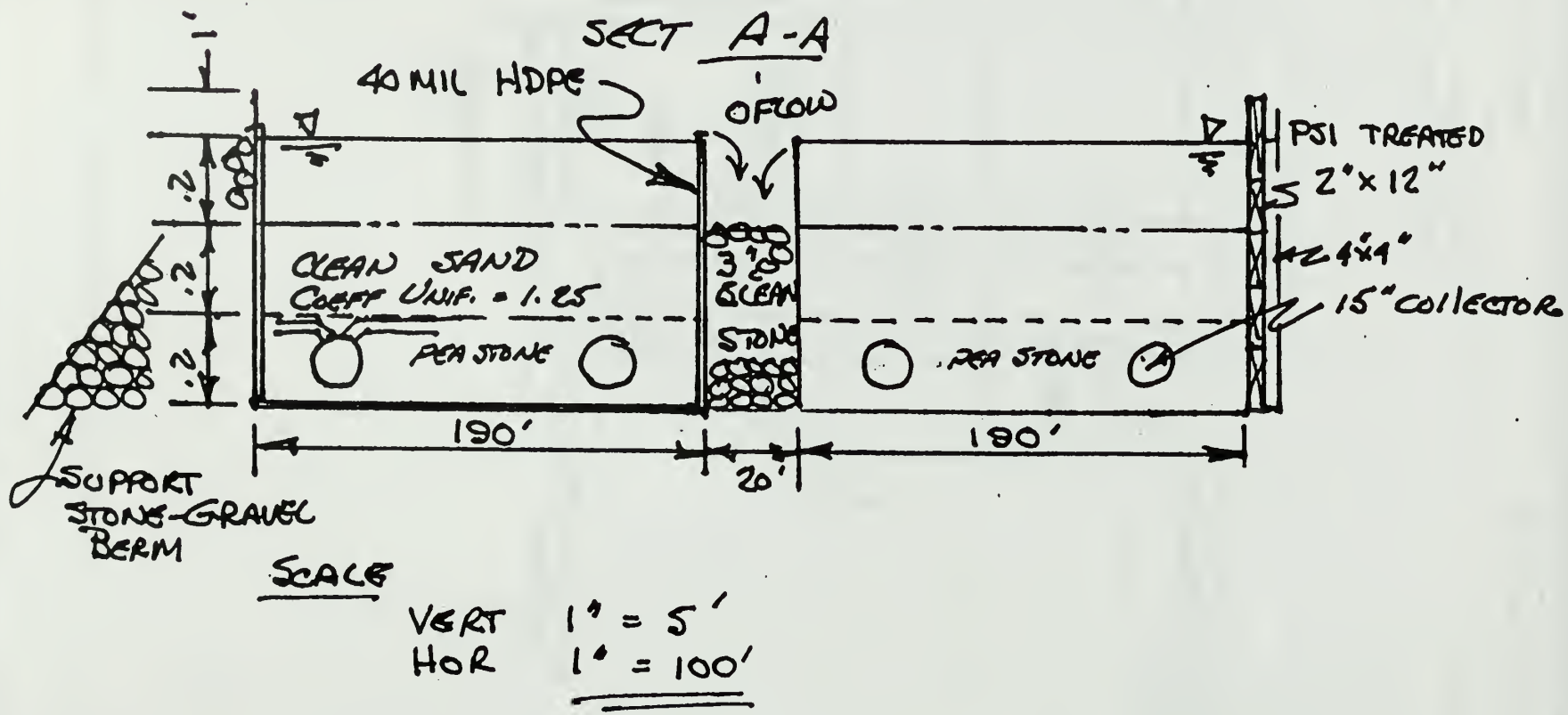


Figure 6. Section of Slow Sand Filter



Proposal No. 8

Description

Proposal No. 8 Five-Year Design Life Treatment Plant Versus "Permanent" Treatment Plant.

- Proposal Description: This proposal applies to the portion of Alternative 1 which relates to production of industrial and fisheries water. In this alternative, satisfactory water is provided by means of an infiltration gallery followed by conventional treatment. The thrust of this proposal is to change the concept from installation of a "conventional" treatment plant, designed to last 20 to 50 years, to installation of a plant whose useful life is more in concert with the period of time that the plant will be needed. See Figure Nos. 7 and 8. This proposal applies only to the treatment plant needed for the industrial and fisheries needs located adjacent to the Elwha River. It does not apply to municipal treatment.

- Critical Items to Consider: The critical aspect of this proposal is the underlying assumption that this treatment plan will only be needed for five years. At the end of this period the facilities installed will become redundant and may be removed. The water for these applications does not need to be of drinking water quality.

- Ways to Implement: To implement this proposal requires that the mind set be changed from that of building a permanent plant to that of building a temporary facility. With this change in orientation, a variety of alterations that materially reduce the cost become possible. The treatment capacity remains at 58 mgd (90 cfs).

- Changes from the Baseline Concept: The following changes are proposed:
  - Replace 48-inch jacked pipeline in tunnel with upwell at entrance to tunnel and changes to diversion structure at end of tunnel to provide driving head.
  - Move facility and change orientation according to Figure 7. This reduces or eliminates a considerable amount of site piping.
  - Replace the concrete basins in the plant with a structure made of H piles and wood lagging side walls, supporting a basin lined with an impermeable fabric.
  - Replace the agitated flocculation chambers with a maze constructed of piles and plywood. Plan view is shown in Figure 8.
  - Increase the flow through the tube settlers. The quality of water required from this facility is considerably less than that for which tube settlers are conventionally designed. For the purpose of this cost estimate, the flow rate through the settlers has been doubled and the quantity of settlers required has been halved.
  - Use one coagulant (poly aluminum chloride) instead of providing for two and replace the 100-foot by 100-foot chemical/utility building with a prefabricated building with a minimum 20-foot by 50-foot dimensions.
  - Decrease system instrumentation to the minimal amount absolutely required.
  - Replace permanent sanitary facilities with temporary facilities.

Proposal No. 8

Other changes like not paving the parking lot should be considered.

Advantages	Disadvantages
• The capital cost of the five-year life plant is expected to be cheaper than that of the permanent plant. Details are shown in Table 8.1 • The five-year life plant will be considerably easier and more economical to remove than the permanent plant. • Considerably less damage will be done to the environment. • Some of the materials, such as wall structures and tube settlers, may be reusable in other facilities.	• The five-year treatment plant will not have the professional appearance of the permanent plant.

Potential Risks

The quality of water from the proposed plant is not as high as that which would be expected from the designed plant. This slightly increases the risk that the treated water will not meet quality requirements. Unfortunately, the risk that this will occur is not quantifiable for either plant.

Cost Items	Nonrecurring Costs
Original Baseline Concept	$ 47,477,000
Value Concept	$ 32,000,000
Avoidance	$ 15,477,000
Value Study Costs	$ 25,000
Implementation Costs	$ 0
Net Avoidances	**$ 15,452,000**

Table 8.1 - Comparison of Alternative Costs

Item	Permanent Plant Cost	Five-year Plant Cost
Mobilization, Demobilization, Bonds & Insurance	$2,762,240	$2,200,000
Temporary Pump Station	$250,000	$250,000
Division 1 - General Requirements	**$3,012,240**	**$2,450,000**
Infiltration Gallery	$11,304,000	$11,304,000
Infiltration Gallery	**$11,304,000**	**$11,304,000**
Site Preparation	$25,000	$25,000
Dewatering	$250,000	$250,000
Earthwork	$216,000	$50,000
Backfill	$187,500	$187,500
Excavation Rock	$250,000	$250,000
Riprap	$12,000	$12,000
Inlet Piping	$690,000	$0
30-inch Pipe to Tribal Fishery	$1,296,000	$840,000
24-inch Pipe from Plant to State Fishery	$67,500	$5,000
12-inch Pipe to Ocean Outfall	$332,500	$350,000
Sanitary Sewer Pipe	$10,500	$0
Sanitary Sewer Manholes	$7,500	$0
Septic Tank	$2,500	$0
Leaching Field	$3,500	$0
10 mil HDPE		$4,320
Wood Baffles		$90,000
Exterior Walls, wood 3-inch thick treated		$100,000
4-foot x 6-inch wood piles 1/3 of length driven		$30,000
Primary Electrical to Treatment Site	$100,000	$100,000
Secondary Electrical	$7,000	$7,000
Drainage and Containment - Flood Protection Berms	$52,500	$0
Storm Drainage - Storm Piping	$140,000	$0
Paving (90 x 40)	$12,000	$12,000
Gravel Site Access Road	$100,000	$100,000
Site Improvements & Amenities	$20,000	$20,000
Site Security Fencing	$37,500	$37,500
Division 2 - Site Construction	**$3,819,500**	**$2,470,320**
Cast-in-place Concrete	$1,600,000	$45,000
Division 3 - Concrete	**$1,600,000**	**$45,000**

Aluminum Grating	$65,000	$0
Handrails	$62,500	$0
Division 5 - Metals	**$127,500**	**$0**
Diffuser Walls	$48,000	$0
Tube Settlers	$1,725,000	$862,500
Water Treatment Pumps - to WFDW Channel Inlet	$60,000	$0
Mixing and Flocculation - Inline Blenders	$120,000	$0
Vertical Floc Mixers	$120,000	$0
Chemical Feed Pumps	$13,500	$13,500
Chemical Feeding Equipment - Diffusers	$7,000	$7,000
Slide Gates - (6-foot x 6-foot)	$70,000	$70,000
Sludge Pumps (Ocean Outfall)	$130,000	$130,000
Chain and Scraper Sludge Collector	$400,000	$400,000
Lab Equipment	$35,000	$35,000
Division 11 - Equipment	**$2,728,500**	**$1,518,000**
Pre-engineered Structure - Office & Lab Building	$1,000,000	$100,000
Chemical Tanks (5000 gallon)	$30,000	$15,000
Division 13 - Special Construction	**$1,030,000**	**$115,000**
Water Meters	$13,500	$13,500
Process piping - Chemical Piping	$5,000	$5,000
Process Piping - Sludge Piping	$50,000	$50,000
Flow Control and Metering Station to Tribe - Equipment	$85,000	$85,000
Flow Control and Metering Station to Tribe - Vault	$85,000	$85,000
Division 15 - Mechanical	**$238,500**	**$238,500**
Diesel Generator Set - Emergency Power & Fuel Tank	$150,000	$150,000
Electrical Instrumentation and Control (20-percent)	$4,249,600	$800,000
Division 16 - Electrical	**$4,399,600**	**$950,000**
Subtotal	**$28,259,840**	**$19,090,820**
Contingency (40-percent)	$11,303,936	$7,636,328
Subtotal	**$39,563,776**	**$26,727,148**
Engineering, Survey and Construction Management (20-percent)	$7,912,755	$5,345,430
Total	**$47,476,531**	**$32,072,578**
Round to	**$47,477,000**	**$32,000,000**

Figure 7. Plan View of Temporary Plant

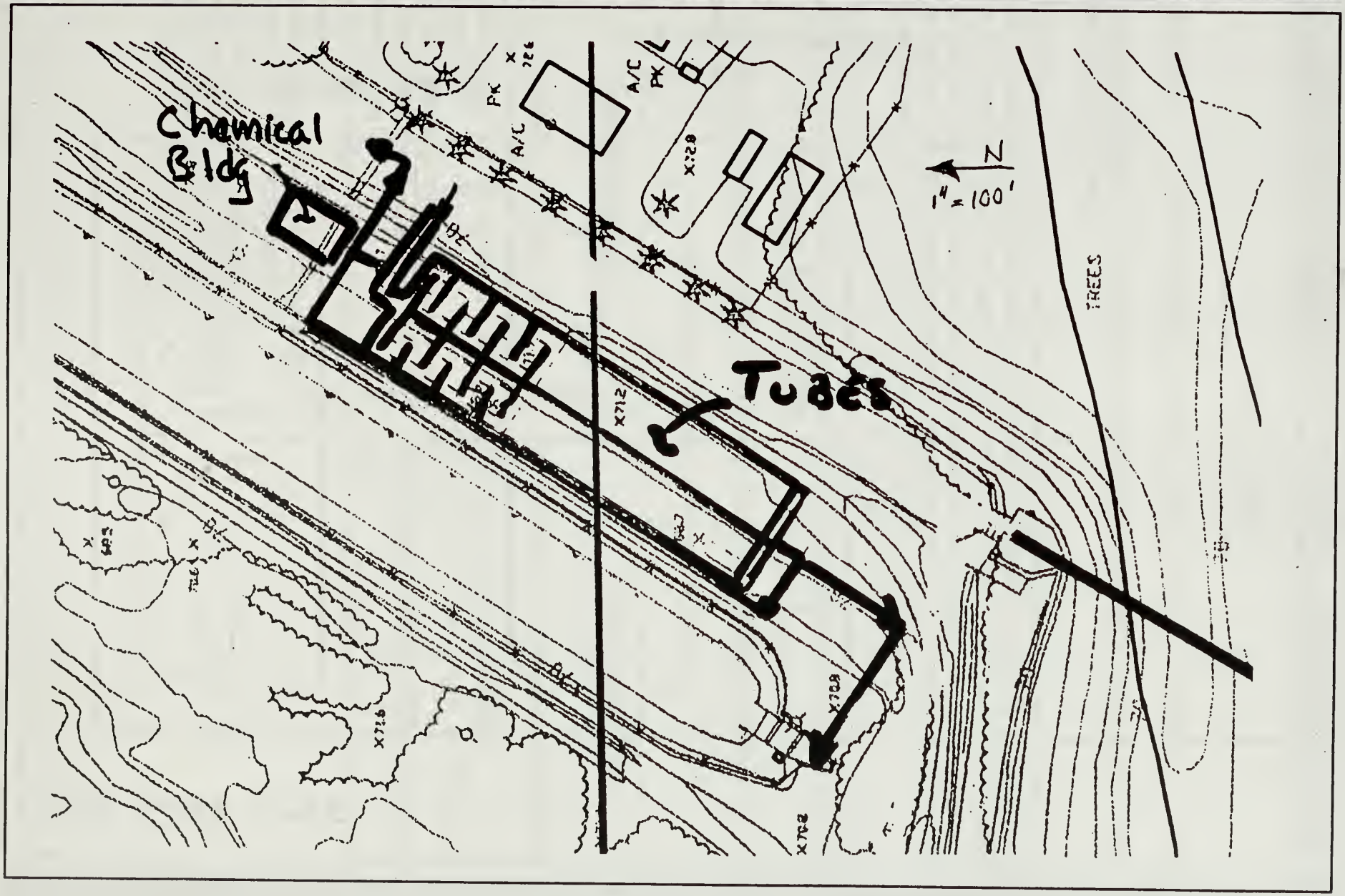
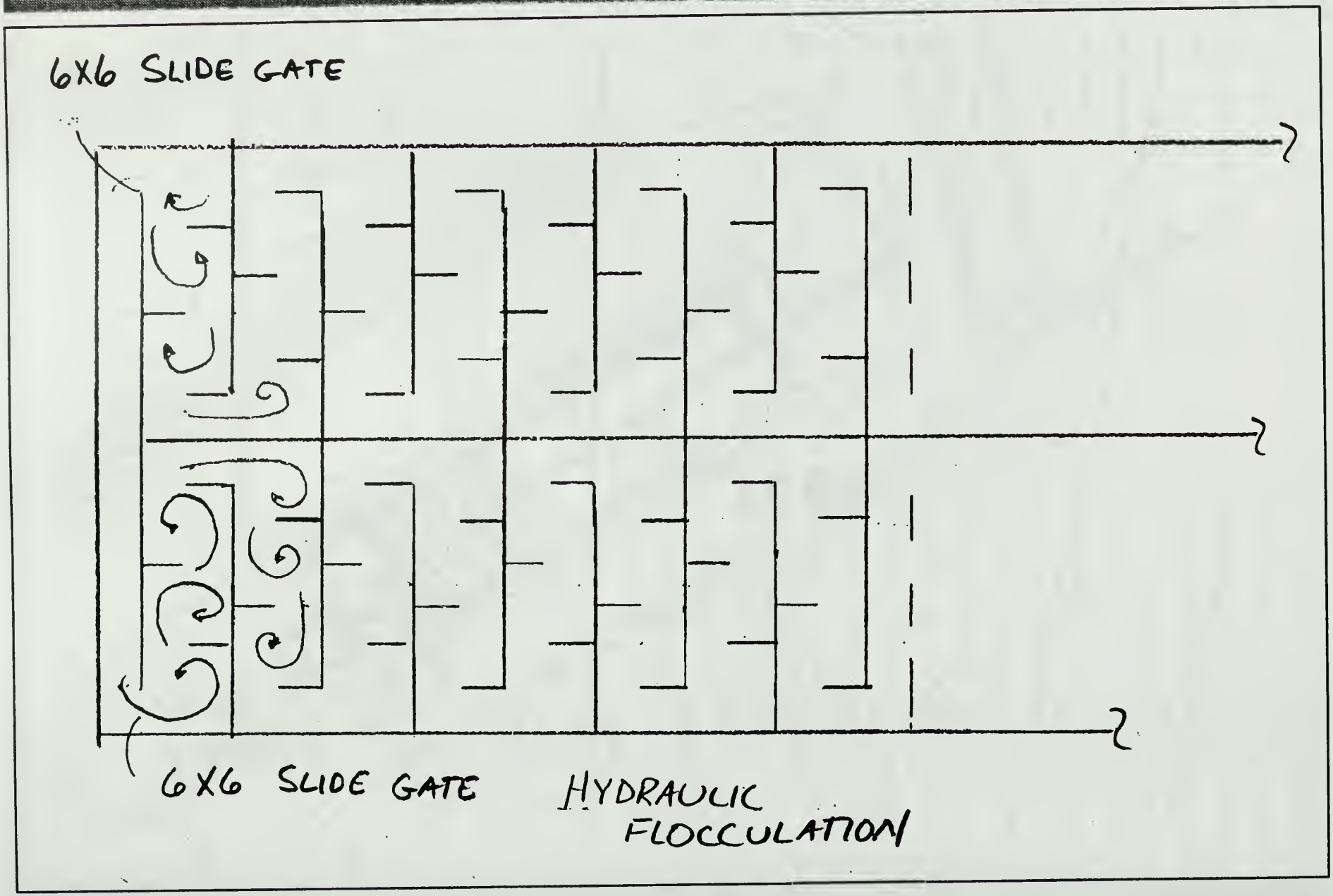


Figure 8. Hydraulic Flocculation



Proposal No. 9

Description

Proposal No. 9. Replace Ranney Collectors in Alternative No. 2 With Horizontal Wells.

- Proposal Description: Horizontal wells will be placed under and adjacent to the river to provide all water needs.

- Critical Items to Consider: Placement of the horizontal wells should avoid areas of intense scour. The depth of the horizontal wells should be considered carefully to achieve a good balance between yield and water quality. Drilling technique will depend on site specific conditions. Either dig a pit and then drill horizontally, or straight line drill at an angle. Contractor must have capability to install horizontal wells. The turbidity of the water from the horizontal wells may be greater than that from Ranney Collectors.

- Ways to Implement: Approximately 30 horizontal wells are installed, either under the river or along-side the river depending on site specific conditions. Wells are shallow, say 5 to 10 feet, to encourage introduction of surface water.

- Changes from the Baseline Concept: The wells replace the Ranney Collectors for industrial water supply.

Advantages	Disadvantages
• Can be installed to operate as a surface diversion and minimize mining groundwater, which may be in short supply • Greater flexibility regarding placement. • Less interference between wells if you spread them out. • Tailor each well to the conditions on site. • Fewer wells needed than with a well-point system or vertical wells. • May be less disturbance than an infiltration gallery or Ranney Collector. • Easier to develop than Ranney Collector or infiltration gallery.	• If a boulder is encountered during drilling may need to relocate well. • Specialty contractor needed. • May not be able to recover all casings when finished. • Actual yield of each well is unknown until it is in place. • Yield of each well may change over the life of the project.

Proposal No. 9

Potential Risks

Risk of pipe collapse. Horizontal wells do not work well in fine grain material.

Cost Items	Nonrecurring Costs
Original Baseline Concept	$ 32,155,000
Value Concept	$ 3,000,000*
Avoidance	$ 29,155,000
Value Study Costs	$ 25,000
Implementation Costs	$ 0
Net Avoidances	**$ 29,130,000**

*Cost of horizontal well assumed to be 200-percent of vertical cased well

Disposition of Ideas

Value Study Elements Considered as Potential Proposals and Their Disposition	
Idea	**Disposition**
Time the removal of the lowest 30 feet of the dams for January - March, when water demand is low.	Developed as Proposal No. 2
Remove the Dams without using the diamond wire saw.	Refer to design team for consideration.
Build only one new Ranney well, across the river from the existing well, and well fields. (Ranney wells close to the Reservation may aggravate salt water intrusion problems.)	Refer to design team for consideration.
Use the 10 acres of wetlands adjacent to the State Hatchery for a pre-sedimentation basin.	Developed as Proposal No. 6.
Deliver 1,000 parts per million water to the Daishowa Mill for short (high concentration) periods and help the mill with solids disposal.	Refer to design team for consideration.
Revise the hydrogeologic study to include salt water intrusion and well field analyses.	Already being done in hydrogeologic study.
Lower the dams in smaller steps (lower and more frequent sediment discharges).	Refer to design team for consideration.
Revise the fish windows.	Refer to design team for consideration.
Remove the sediments from behind the dams more rapidly.	Refer to design team for consideration.
Blend surface with fish hatchery water.	Refer to design team for consideration.
Blend surface and well water.	Refer to design team for consideration.
Use Army Reserve/National Guard water purification units (up to 100,000 gallons per day per unit).	Refer to design team for consideration.
Use an unlined dike reservoir for a storage reservoir	Refer to design team for consideration.
Increase interaction between Dam Removal, Flood Control, and Water Mitigation Teams.	Developed as Proposal No. 1.
Imitate the 100-year flood event (in January).	Refer to design team for consideration.
Confine sediment effects to January-February.	Refer to design team for consideration.

Disposition of Ideas	
Blow up the dams (or lowest portion) and accelerate the sediment passage.	Developed as Proposal Nos. 3 and 4.
Avoid the need for supplemental Environmental Impact Statements.	Refer to design team for consideration.
Place a filter cloth at the tunnel entrance.	Determined by the study team to be less feasible due to product limitations and cost.
Construct plywood or other temporary treatment facility with a 5-year design life and 3-month active use period.	Developed as Proposal No. 8.
Use Jersey barriers and plastic for basin walls.	Refer to design team for consideration.
Use Ecology blocks for basin walls.	Refer to design team for consideration.
Use a slow sand filter instead of treatment for industrial (and fisheries) water.	Developed as Proposal No. 7.
Use horizontal wells under the river.	Developed as Proposal No. 9.
Use well points instead of infiltration gallery.	Developed as Proposal No. 5.
Add laterals to the existing Ranney Well.	Refer to design team for consideration.

List of Consultants

Consultant or Contact	Topic or Information
Tim Randle Hydraulic Engineer USBR, Technical Service Center, D-8540 PO Box 25007, Denver CO 80225 303-445-2557	Elwha River Sedimentation Model, assumptions and development.
Roy Elliott Hydraulic Engineer URS, Seattle, WA 206-728-0744	Hydrogeologic Study goals, components, anticipated limits on use of data collected.
Bob Talbot Hydraulic Engineer USBR, Technical Service Center, D-8540 PO Box 25007, Denver CO 80225 303-45-2518	Well Points and horizontal wells
Dean Reed Daishowa America Port Angeles WA 98362 360-452-0657	Paper Mill average annual day and maximum day water demands

Data and Documents Consulted

Title, Author, and Date	Information
February 5th VST Meeting Project Documents, URS Corporation, Greg Blais, January, 2001.	75-percent concept alternative components, cost estimates.
Draft Elwha Water Quality Mitigation Project (DEWQM report) November 6, 2000, URS Corporation.	Performance of Ranney Wells and cost estimates.
Elwha River Ecosystem and Fisheries Restoration Project - Sediment Analysis and Modeling of River Erosion Alternatives, U.S. Department of the Interior, October 1966. Tim Randle, Hydraulic Engineer, Sedimented River Hydraulics Group, U.S. Department of the Interior, Bureau of Reclamation, Technical Service Center, Denver, Colorado.	Sediment loading concentrations.

Data and Documents Consulted

Elwha River Ecosystem Restoration, Final Environmental Impact Statement, Olympic National Park, June 1995.	Projected Elwha water quality and proposed mitigation measures.
Elwha River Ecosystem Restoration Implementation, Draft Environmental Impact Statement, Olympic National Park, April 1996.	Water Quality Mitigation Issues.
Elwha River Ecosystem Restoration Implementation, Final Environmental Impact Statement, Olympic National Park, November 1996.	Water quality mitigation issues and concepts.
Elwha River Restoration Project, Washington, Elwha Technical Series PN-95-4, Alluvium Distribution in Lake Mills, Glines Canyon Project and Lake Aldwell, Elwha Project, USBR, August, 1995.	Filtration requirements.
Removal of Elwha and Glines Canyon Dams, Elwha Technical Series PN-95-7, USBR, May 1996.	Sedimentation loadings.
Water Quality Analysis and Mitigation Measures, Elwha Technical Series PN-95-8, USBR, March 1997.	Projected Elwha water quality, conceptual design of mitigation measures described in IEIS.
Suspended Sediment Filtration Through Riverbed Investigation, Gathard Engineering and Consulting.	Ranney Collector data for Lower Elwha-Klallam Hatchery.
Ground-Water Resource Assessment Technical Memorandum, Bureau of Reclamation, October 1995 (September 1999).	Available groundwater quantities for water source.
Elwha River Ecosystem and Fisheries Restoration Project, Elwha Technical Series PN-95-9, (sedimentation analysis and modeling) BOR, October 1996.	Sediment loadings and concentrations.
Report of Hydrologic Services Water Supply Feasibility Study, Tribal Fish Culture Facility, Geoengineers, June 1994.	Water quality, quantity and needs.
Preliminary Evaluation of Elwha Dam Removal Mitigation Alternatives and Integration with Regional Supply Objectives, CH2M Hill, 1999.	Current project and proposals.

Data and Documents Consulted

Permanent Treatment for Port Angeles' Domestic Water Supply as a Result of Removal of the Elwha Dams, CH2M Hill, 1999.	Current project and proposals.

Design Team Presentation Attendance List February 5, 2001 - 8:30 a. m.

Name/Title/Discipline	Address/Phone Number
Norm Hyndman Value Study Team Leader General Engineer	Bureau of Reclamation, Technical Service Center PO Box 25007 (D-8170), Denver CO 80225-0007 Phone: 303-445-3251 FAX: 303-445-6475 E-mail: nhyndman@do.usbr.gov
Ellen Abart Design Team Leader	Bureau of Reclamation, Technical Service Center PO Box 25007 (D-8230), Denver CO 80225-0007 Phone: 303-445-2247 FAX: 303-445-6329 E-mail: eabart@do.usbr.gov
Frank Leitz Chemical Engineer	Bureau of Reclamation, Technical Service Center PO Box 25007 (D-8230), Denver CO 80225-0007 Phone: 303-445-2255 FAX: 303-445-6329 E-mail: fleitz@do.usbr.gov
Gary Rosenlieb Hydrologist, Water Quality Coordinator	National Park Service, 1201 Oakridge Drive, Suite 250, Fort Collins, CO 80525 Phone: 970-225-3518 FAX: 970-225-9965 E-mail: gary_rosenlieb@nps.gov
Ken Hartz Senior Treatment Engineer Consultant to USBR	URS Corporation 25702 75th Avenue SW, Vashon, WA 98070 Phone: 206-463-6667 FAX: 206-463-6671 E-mail: hartz2000@msn.com
Tim Volz Regional Water Resources Director Consultant to USBR	URS Corporation 8415 Explorer Dr, Suite 110, Colorado Springs, CO 80920 Phone: 719-533-7845 FAX: 719-531-0007 E-mail: tim_volz@urscorp.com
Stephen Sperr Utility Engineer	City of Port Angeles 321 East 5th Street, Port Angeles, WA 98362 Phone: 360-417-4821 FAX: 360-417-4709 E-mail: utilengr@ci.port-angeles.wa.us

Design Team Presentation Attendance List February 5, 2001 - 8:30 a. m.	
Mark Carlson Consultant to the City of Port Angeles	CH2M Hill 2300 NW Walnut Boulevard, Corvallis, OR 97330 Phone: 541-7524271 FAX: 541-752-0276 E-mail: MCarlso1@CH2M.com
Dennis Gathard Engineering Consultant to the Lower Elwha Klallam	GEC 3829 Burke Avenue North, Seattle, WA 98103 Phone: 206-547-4148 Fax: 206-547-4052 E-mail: dgathard@riveresources.com
Greg Blais Project Engineer	URS Corporation, Stanford Place 3, Suite 1000 4582 South Ulster Street, Denver, CO 80237 Phone: 303-694-2656 FAX: 303-694-3946 E-mail: greg_blais@urscorp.com
Jim Ris Project Manager	URS Corporation, Stanford Place 3, Suite 1000 4582 South Ulster Street, Denver, CO 80237 Phone: 303-694-2600 FAX: 303-694-3946 E-mail: jim_ris@urscorp.com

Value Study Team Presentation Attendance List
February 9, 2001 - 1 p. m.

Name/Title/Discipline	Address/Phone Number
Norm Hyndman Value Study Team Leader General Engineer	Bureau of Reclamation, Technical Service Center PO Box 25007 (D-8170), Denver CO 80225-0007 Phone: 303-445-3251 FAX: 303-445-6475 E-mail: nhyndman@do.usbr.gov
Ellen Abart Design Team Leader	Bureau of Reclamation, Technical Service Center PO Box 25007 (D-8230), Denver CO 80225-0007 Phone: 303-445-2247 FAX: 303-445-6329 E-mail: eabart@do.usbr.gov
Frank Leitz Chemical Engineer	Bureau of Reclamation, Technical Service Center PO Box 25007 (D-8230), Denver CO 80225-0007 Phone: 303-445-2255 FAX: 303-445-6329 E-mail: fleitz@do.usbr.gov
Gary Rosenlieb Hydrologist, Water Quality Coordinator	National Park Service, 1201 Oakridge Drive, Suite 250, Fort Collins, CO 80525 Phone: 970-225-3518 FAX: 970-225-9965 E-mail: gary_rosenlieb@nps.gov
Tim Volz Regional Water Resources Director Consultant to USBR	URS Corporation 8415 Explorer Dr, Suite 110, Colorado Springs, CO 80920 Phone: 719-533-7845 FAX: 719-531-0007 E-mail: tim_volz@urscorp.com
Stephen Sperr Utility Engineer	City of Port Angeles 321 East 5th Street, Port Angeles, WA 98362 Phone: 360-417-4821 FAX: 360-417-4709 E-mail: utilengr@ci.port-angeles.wa.us
Mark Carlson Consultant to the City of Port Angeles	CH2M Hill 2300 NW Walnut Boulevard, Corvallis, OR 97330 Phone: 541-7524271 FAX: 541-752-0276 E-mail: MCarlso1@CH2M.com
Dennis Gathard Engineering Consultant to the Lower Elwha Klallam	GEC 3829 Burke Avenue North, Seattle, WA 98103 Phone: 206-547-4148 Fax: 206-547-4052 E-mail: dgathard@riveresources.com
Greg Blais Project Engineer	URS Corporation, Stanford Place 3, Suite 1000 4582 South Ulster Street, Denver, CO 80237 Phone: 303-694-2656 FAX: 303-694-3946 E-mail: greg_blais@urscorp.com

Value Study Team Presentation Attendance List
February 9, 2001 - 1 p. m.

Jim Ris Project Manager	URS Corporation, Stanford Place 3, Suite 1000 4582 South Ulster Street, Denver, CO 80237 Phone: 303-694-2600 FAX: 303-694-3946 E-mail: jim_ris@urscorp.com
Brian Winter Elwha Project Manager	National Park Service, Elwha Restoration Project Office 826 E. Front Street, Suite A, Port Angeles, WA 98362-3613 Phone: 360-565-1323 FAX: 360-565-1325 E-mail: brian_winter@nps.gov
Michelle Chapman-Wilbert	Bureau of Reclamation, Technical Service Center Water Treatment Engineering & Research PO Box 25007 (D-8230), Denver CO 80225-0007 Phone: 303-445-2264 FAX: 303-445-6329 E-mail: mchapman@do.usbr.gov
Jennifer Bountry	Bureau of Reclamation, Technical Service Center PO Box 25007 (D-8540), Denver CO 80225-0007 Phone: 303-445-3614 FAX: 303-445-6351 E-mail: jbountry@do.usbr.gov
Tom Hepler	Bureau of Reclamation, Technical Service Center PO Box 25007 (D-8130), Denver CO 80225-0007 Phone: 303-445-3261 FAX: 303-445-6490 E-mail: thepler@do.usbr.gov
Tim Randle	Bureau of Reclamation, Technical Service Center PO Box 25007 (D-8540), Denver CO 80225-0007 Phone: 303-445-2557 FAX: 303-445-6351 E-mail: trandle@do.usbr.gov

APPENDIX

7-1654 (1-89)
Bureau of Reclamation

COMPUTATION SHEET

BY	DATE 2-7-01	PROJECT ELWHA	SHEET 1 OF
CHKD BY	DATE	FEATURE SAND FILTER	
DETAILS Proposal 7			

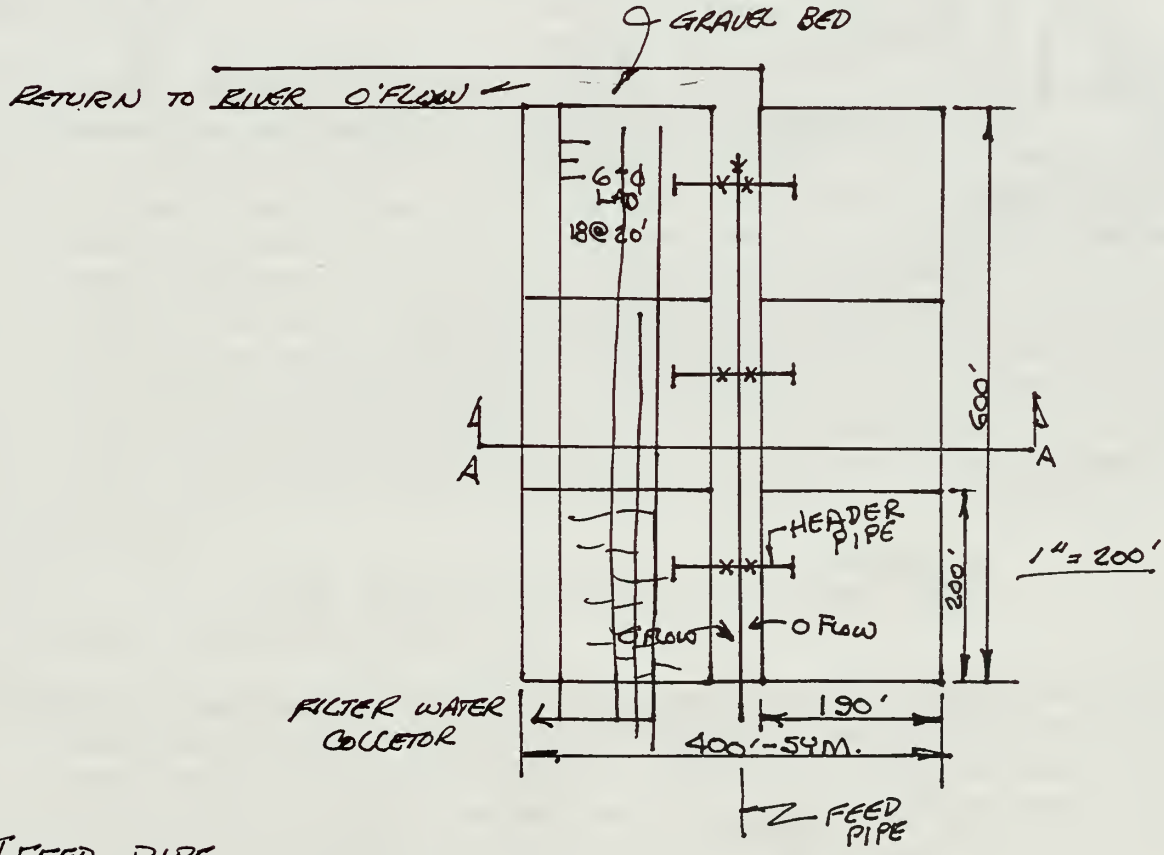
I ASSUMPTIONS

A. FEED WATER FROM PRE-SED BASIN @ 1500 PPM
B. FILTERED WATER DEMAND @ 30 cfs = 19.4 MGD
C. AVERAGE HLR = 100 GAL/FT²/DAY = .07 GPM/FT²
D. 6 BAYS/5 ACTIVE

II AREA

A. 19.4 MGD/100 GPD = 193,833. FT² = 4.45 ACRE
4.45 × 6/5 = 5.34 ACRES TOTAL = .89 AC/BAY = 38,768 FT

B. BAY
190 × 200 = 38,000 FT²



III FEED PIPE

30 cfs @ 5 FPS = 6 FT² = 2.76' ≅ 30" ϕ

HEADER PIPE
6 cfs @ 5 FPS = 1.2 FT² = 14" ϕ OR 15" ϕ

COLLECTOR
~~4 @ 7.5 CFS = 30 cfs @ 6 FPS = 15" ϕ~~
5 @ 6 cfs = 30 cfs @ 6 FPS = 12" ϕ

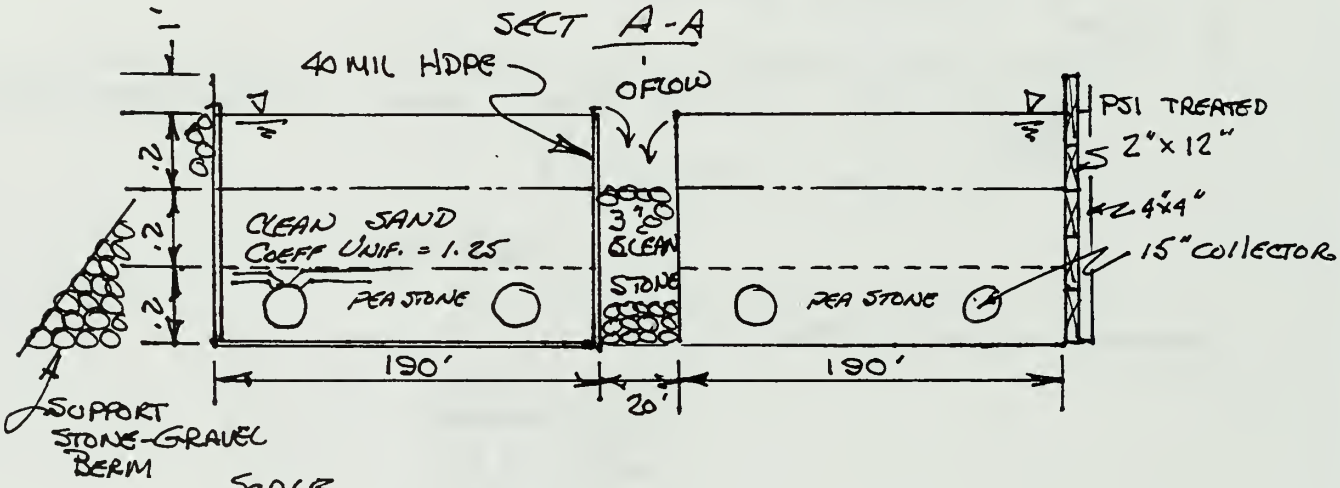
7-1654 (1-89)
Bureau of Reclamation

COMPUTATION SHEET

BY	DATE	PROJECT	SHEET 2 OF ____
CHKD BY	DATE	FEATURE SAND FILTER	
DETAILS			

~~A-A~~

COLLECTOR LATS - @ 20' CTRS @ 150'
18 LATS = .33 CFS @ @ 1.1 FPS = .3 FT² ≈ 6"ϕ



SCALE

VERT 1" = 5'
HOR 1" = 100'

PUMP

10' HEAD
19.4 MGD / 4 PUMPS = 3,370 GPM

4@ Hp = $\frac{3370 \times 10}{3960 \times .7}$ = ~~12 1/2~~ Hp. ~~EA.~~ 15 Hp EA.

10"ϕ BARREL

PAGE 8 OF 10
Vlng 7/31/00

TABLE 8.1 Surface Area Requirements of Sediment Traps and Basins

Particle size, mm		Settling velocity, ft/sec (m/sec)		Surface area requirements, ft^2 per ft^3/sec discharge	(m^2 per m^3/sec discharge)
0.5	(coarse sand)	0.19	(0.058)	6.3	(20.7)
0.2	(medium sand)	0.067	(0.020)	17.9	(58.7)
0.1	(fine sand)	0.023	(0.0070)	52.2	(171.0)
0.05	(coarse silt)	0.0062	(0.0019)	193.6	(635.0)
0.02	(medium silt)	0.00096	(0.00029)	1,250.0	(4,101.0)
0.01	(fine silt)	0.00024	(0.000073)	5,000.0	(16,404.0)
0.005	(clay)	0.00006	(0.000018)	20,000.0	(65,617.0)

weight composed of particles in the 0.01- to 0.02-mm range. A surface area 4 times larger would be needed to capture 5 percent more of this soil.

A balance between the cost-effectiveness of a certain basin size and the desire to capture fine particles must be achieved. It is desirable to capture the very small soil particles (clays and fine silts) because they cause turbidity and other water quality problems. However, Table 8.1 shows that a basin would have to be very large to capture particles smaller than 0.02 mm, particularly clay particles 0.005 mm and smaller. Because of the high cost of trapping very small particles, the authors recommend 0.02 as the design particle size for sediment basins except in areas with coarse soils, where a larger design particle may be used. The 0.02-mm particle is classified as a medium silt by the AASHTO soil classification system.

8.2d Basin Discharge Rate

The peak discharge, calculated by the rational or another approved method, is used to size the basin riser. During any major storm, a sediment basin should fill with water to the top of its riser and then discharge at the rate of inflow to the basin. A sediment basin is not designed with a large water storage volume as is a reservoir. If the inflow exceeds the design peak flow used to size the riser, the overflow should discharge down an emergency spillway.

8.2e Design Runoff Rate

In the equation for surface area of a sediment basin, the discharge rate Q is a variable to be chosen by the designer. The above discussion of basin discharge rate shows that the discharge rate is, to a large extent, equal to the inflow. The riser is sized to handle the peak inflow to the basin. The authors suggest determining the surface area by the *average runoff of a 10-year, 6-hr storm* instead